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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/029,204	12/28/2001	Kenji Shimizu	Q63141	5380

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EXAMINER

BERNATZ, KEVIN M

ART UNIT

PAPER NUMBER

1773

DATE MAILED: 04/04/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

F-K

Office Action Summary	Application No.	Applicant(s)	
	10/029,204	SHIMIZU ET AL.	
	Examiner	Art Unit	
	Kevin M Bernatz	1773	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-21 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____. | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Specification

1. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and ***generally limited to a single paragraph within the range of 150 words or 15 lines (37 CFR 1.72). See MPEP § 608.01(b).***

The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

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(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1 – 7, 9 – 11, 13, 14, 16 – 18, 20 and 21 are rejected under 35

U.S.C. 102(b) as being anticipated by Hikosaka et al. (U.S. Patent No. 5,792,564).

Regarding claims 1, 16 and 20, Hikosaka et al. disclose a magnetic recording medium comprising, in sequence, on a nonmagnetic substrate (*Figure 4, element 11*), at least one soft magnetic underlayer (*element 12*), a non-magnetic layer (i.e. applicants' "orientation control layer" - *element 13*), and a perpendicular magnetic layer (*element 1 and col. 4, lines 16 - 21*), wherein said soft magnetic underlayer has a multilayer structure (*Figure 5*) having a plurality of soft magnetic layers comprising a soft magnetic material (*element 12 and col. 10, lines 25 – 26*), and one or more separation layers (*element 14*) interposed between said soft magnetic layers (*Figure 5*), and at least one of said soft magnetic layers comprises a material with a structure having no magnetic domain walls (*col. 3, lines 43 – 46; col. 10, lines 15 – 20; and col. 22, lines 10 - 20*).

The limitation(s) "to control the orientation of the layer immediately above" is (an) intended use limitation(s) and is not further limiting in so far as the structure of the product is concerned. "[I]n apparatus, article, and composition claims, intended use must result in a **structural difference** between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. **If the prior art structure is capable of performing the intended use, then it meets the claim.** In a

claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art.” [emphasis added] *In re Casey*, 370 F.2d 576, 152 USPQ 235 (CCPA 1967); *In re Otto*, 312 F.2d 937, 938, 136 USPQ 458, 459 (CCPA 1963). See MPEP § 2111.02. Since all layers effect the grain epitaxy of the layers subsequently deposited (either by grain growth or improved adhesion, etc), the non-magnetic layer (*element 13*) is therefore deemed to be clearly “capable of performing the intended use”.

The limitation “having an axis of easy magnetization which is oriented mainly perpendicular to the nonmagnetic substrate” is simply the definition of a perpendicular magnetic layer and is therefore met by the disclosed Hikosaka et al. magnetic layers (*see also Figure 10*).

The apparatus element “and a magnetic head for carrying out recording and reproducing of information to and from the magnetic recording medium” is a nominal element for a magnetic recording and reproducing device, as shown by Hikosaka et al. (*Figures 6 - 10*).

Regarding claims 2, 13, 17 and 21, Hikosaka et al. disclose soft magnetic layers meeting applicants’ claimed limitations (*col. 9, lines 20 - 25*).

Regarding claims 3 and 4, Hikosaka et al. disclose embodiments meeting applicants’ claimed limitations (*Figure 5 wherein element 14 is disclosed to be formed from an “artificial lattice films such as CoFe/Cu films” – col. 11, lines 1 – 10. The Examiner notes that CoFe is a known soft magnetic film*).

Regarding claims 5 - 7, Hikosaka et al. disclose embodiments meeting applicants' claimed limitations (*col. 10, lines 25 – 30 and col. 14, lines 54 – 55; wherein CoFeTa is known to possess a saturation magnetic flux density ($B_s \sim 4\pi M_s$) of greater than 0.4 T, giving a $B_s \cdot t$ value of at least 40 T nm for the disclosed 100 nm layers – see pertinent prior art cited below - Saito*).

Regarding claims 9 – 11 and 18, it has been held that where claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes, a *prima facie* case of either anticipation or obviousness has been established and the burden of proof is shifted to applicant to show that prior art products do not necessarily or inherently possess characteristics of claimed products where the rejection is based on inherency under 35 USC 102 or on *prima facie* obviousness under 35 USC 103, jointly or alternatively. Therefore, the *prima facie* case can be rebutted by **evidence** showing that the prior art products do not necessarily possess the characteristics of the claimed product. *In re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977). “When the PTO shows a sound basis for believing that the products of the applicant and the prior art are the same, the applicant has the burden of showing that they are not.” *In re Spada*, 911 F.2d 705, 709, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990).

In the instant case, the disclosed structure in Figure 5 comprises alternating layers of antiferromagnetic material and soft ferromagnetic material exchange coupled together by the bias field generated by the antiferromagnetic layers (*col. 10, lines 5 – 37*). Antiferromagnetically coupled layers are known to have directions of magnetization

antiparallel to one another and since Hikosaka et al. discloses that the bias field "is applied normal to the recording track of the medium (i.e. in the radial direction of the medium)" (*col. 10, lines 15 – 20 and see pertinent prior art cited below – Fullerton et al.*).

Therefore, in addition to the above disclosed limitations, the presently claimed properties of "at least one set has different direction ... layers" (*claim 9*), "at least one set has ... antiparallel" (*claim 10*), and "the direction of the magnetization ... the center of the nonmagnetic substrate" (*claims 11 and 18*) would have inherently been present because the disclosed ferromagnetic/antiferromagnetic layers are known in the art to produce magnetic directions that are antiparallel and Hikosaka et al. teach that the bias magnetic fields are in the radial direction, and there is no evidence currently of record showing that the disclosed prior art products do not necessarily possess the characteristics of the claimed product.

Regarding claim 14, Hikosaka et al. disclose structures meeting applicants' claimed limitations (*Figure 5 – element 12 adjacent to element 13*).

4. Claims 1, 3, 4, 8 – 11, 14, 16, 18 and 20 are rejected under 35 U.S.C. 102(e) as being anticipated by Shukh et al. (U.S. Patent Application No. 2002/0028357 A1).

Regarding claims 1, 16 and 20, Shukh et al. disclose a magnetic recording medium comprising, in sequence, on a nonmagnetic substrate (*Figure 2, element 38*), at least one soft magnetic underlayer (*element 40*), a spacer layer (i.e. applicants' "orientation control layer" - *element 42*), and a perpendicular magnetic layer (*element 44*

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and Paragraph 0002), wherein said soft magnetic underlayer has a multilayer structure (Figure 3) having a plurality of soft magnetic layers comprising a soft magnetic material (elements 48 and 52 and Paragraphs 0025 - 0029), and one or more separation layers (element 50, 54 and 56) interposed between said soft magnetic layers (Figure 5), and at least one of said soft magnetic layers comprises a material with a structure having no magnetic domain walls (Paragraphs 0008, 0009 and 0031; wherein Shukh et al. state that the entire soft magnetic layer is a single domain and not plural domains separated by magnetic domain walls: "the soft magnetic underlayer 40 can be maintained in a generally stable single domain state").

The limitation(s) "to control the orientation of the layer immediately above" is (an) intended use limitation(s) and is not further limiting in so far as the structure of the product is concerned for the reasons cited above.

The limitation "having an axis of easy magnetization which is oriented mainly perpendicular to the nonmagnetic substrate" is simply the definition of a perpendicular magnetic layer and is therefore met by the disclosed Shukh et al. magnetic layers.

The apparatus element "and a magnetic head for carrying out recording and reproducing of information to and from the magnetic recording medium" is a nominal element for a magnetic recording and reproducing device, as shown by Shukh et al. (Figures 1 and 2).

Regarding claims 3, 4 and 8, Shukh et al. disclose embodiments meeting applicants' claimed limitations (Figure 3 elements 50, 54 and 56 and Paragraphs 0027 and 0028).

Regarding claims 9 – 11 and 18, Shukh et al. disclose magnetic directions meeting applicants' claimed limitations (*Figures 2 and 3 and Paragraphs 0029 and 0037, wherein the directions shown in Figure 3 are deemed to be in the radial direction based on the perspective view shown in Figure 2*).

Regarding claim 14, Shukh et al. disclose structures meeting applicants' claimed limitations (*Figure 3 – element 52*).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hikosaka et al. as applied above, and further in view of Shukh et al. ('357 A).

Hikosaka et al. is relied upon as described above.

Hikosaka et al. fail to disclose the thickness of the Cu layers used in the CoFe/Cu lattice structures.

However, Shukh et al. teach that the exact thickness of the Cu layer used in a CoFe/Cu superlattice is considered a cause-effective variable based on the desired exchange coupling relationship, and further teaches thickness values meeting applicants' claimed limitations (*Paragraphs 0028 and 0030*).

It would have been obvious to one having ordinary skill in the art to have determined the optimum value of a cause effective variable such as the Cu lattice layer thickness through routine experimentation. *In re Boesch*, 205 USPQ 215 (CCPA 1980), *In re Woodruff*, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

7. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hikosaka et al. as applied above, and further in view of Akiyama et al. (U.S. Patent No. 5,815,342).

Hikosaka et al. is relied upon as described above.

Hikosaka et al. fail to disclose a hard magnetic layer formed between the nonmagnetic substrate and the soft magnetic underlayer, wherein the magnetization of the hard magnetic layer is directed along the radius of the substrate and towards the periphery or the center of the substrate, and bonded with the magnetization of the soft magnetic layer which is the lowest layer of the soft magnetic underlayer.

However, Akiyama et al. teach that one can add a hard bias magnetic layer under a soft magnetic layer in a perpendicular recording medium (*Figure 5, element 25 and col. 10, lines 4 – 12*) resulting in exchange coupling with the soft magnetic layer adjacent to the hard bias magnetic layer in order to suppress the occurrence of domain walls and spike Barkhausen noise (*col. 10, lines 13 – 24*), thereby meeting applicants' claimed limitations.

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicants' invention to modify the device of Hikosaka et al. to include a hard

magnetic layer meeting applicants' claimed limitations as taught by Akiyama et al. in order to suppress the occurrence of domain walls and spike Barkhausen noise.

8. Claims 15 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hikosaka et al. as applied above, and further in view of Tang et al. (U.S. Patent No. 5,750,270).

Hikosaka et al. is relied upon as described above.

Hikosaka et al. fail to disclose oxidizing the surface of the soft magnetic underlayer.

However, Tang et al. teach that soft magnetic layers for perpendicular media can be annealed under oxygen, thereby necessarily oxidizing the surface of the soft magnetic underlayer, in order to reduce the media noise (*col. 17, line 45 bridging col. 18, line 20*).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Hikosaka et al. to oxidize the surface of the soft magnetic layer as taught by Tang et al. in order to reduce the media noise.

9. Claims 2, 5 – 7, 13, 15, 17, 19 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shukh et al. as applied above, and further in view of Tang et al. ('270).

Shukh et al. is relied upon as described above.

Regarding claims 2, 13, 17 and 21, Shukh et al. fail to disclose a soft magnetic material meeting applicants' claimed limitations.

However, Tang et al. teach that the soft magnetic materials used by Shukh et al. (*Paragraphs 0026 and 0034*) are known equivalent soft magnetic materials to the claimed soft magnetic compositions (*col. 9, lines 9 – 21*).

Substitution of equivalents requires no express motivation as long as the prior art recognizes the equivalency. In the instant case, NiFe and soft magnetic materials meeting applicants' claimed limitations are equivalents in the field of soft magnetic materials capable of use in perpendicular media. *In re Fount* 213 USPQ 532 (CCPA 1982); *In re Siebentritt* 152 USPQ 618 (CCPA 1967); *Graver Tank & Mfg. Co. Inc. v. Linde Air Products Co.* 85 USPQ 328 (USSC 1950).

Regarding claims 5 - 7, Shukh et al. disclose embodiments meeting applicants' claimed limitations (*Paragraphs 0007, 0026 and 0034; wherein $Ni_{45}Fe_{55}$ is known to possess a saturation magnetization ($M_s = B_s/4\pi$) value of ~ 1.6 T and Shukh et al. explicitly teaches using materials with a $B_s > 1$ T in Paragraph 0007; see pertinent prior art cited below – Inturi et al.*). The examiner further notes that the exact thickness of the soft magnetic layers (and hence, the $B_s t$ values) are cause effective variables in terms of the magnetization force and direction (*Paragraph 0029*). It would, therefore, have been obvious to one having ordinary skill in the art to have determined the optimum value of a cause effective variable such as the soft magnetic layer thickness, and hence also $B_s t$ value, through routine experimentation.

Regarding claims 15 and 19, Tang et al. teach that soft magnetic layers for perpendicular media can be annealed under oxygen, thereby necessarily oxidizing the surface of the soft magnetic underlayer, in order to reduce the media noise (*col. 17, line 45 bridging col. 18, line 20*). It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Shukh et al. to oxidize the surface of the soft magnetic layer as taught by Tang et al. in order to reduce the media noise.

10. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shukh et al. as applied above, and further in view of Akiyama et al. ('342).

Shukh et al. is relied upon as described above.

Shukh et al. fail to disclose a hard magnetic layer formed between the nonmagnetic substrate and the soft magnetic underlayer, wherein the magnetization of the hard magnetic layer is directed along the radius of the substrate and towards the periphery or the center of the substrate, and bonded with the magnetization of the soft magnetic layer which is the lowest layer of the soft magnetic underlayer.

However, Akiyama et al. teach that one can add a hard bias magnetic layer under a soft magnetic layer in a perpendicular recording medium (*Figure 5, element 25 and col. 10, lines 4 – 12*) resulting in exchange coupling with the soft magnetic layer adjacent to the hard bias magnetic layer in order to suppress the occurrence of domain walls and spike Barkhausen noise (*col. 10, lines 13 – 24*), thereby meeting applicants' claimed limitations.

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicants' invention to modify the device of Shukh et al. to include a hard magnetic layer meeting applicants' claimed limitations as taught by Akiyama et al. in order to suppress the occurrence of domain walls and spike Barkhausen noise.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Saito (U.S. Patent No. 5,673,162) teaches $M_s (= B_s/4\pi)$ values for CoFeTa soft magnetic films (*Figure 6*). Inturi et al. (U.S. Patent No. 6,342,311 B1) teach the M_s value of $Ni_{45}Fe_{55}$ (*col. 3, lines 35 – 37*). Fullerton et al. (U.S. Patent No. 6,391,430 B1) teach perpendicular media comprising antiferromagnetically coupled Co, Fe, Ni ferromagnetic films (*Figures and underlined sections*). Kubota et al. (U.S. Patent App. No. 2002/0058159 A1) teach perpendicular recording media using a soft magnetic underlayer wherein the soft magnetic layer preferably comprises a laminate of FeCoB/Ta layers (*Figures and Paragraph 0031*). Sugita et al. (U.S. Patent No. 4,687,712) teach that it is old in the art to form soft magnetic layers into laminates comprising soft magnetic layers separated by thin non-magnetic spacer layers (*Figures; underlined sections; and examples*).

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin M Bernatz whose telephone number is (703) 308-1737. The examiner can normally be reached on M-F, 9:00 AM - 6:00 PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Thibodeau can be reached on (703) 308-2367. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0651.



KMB
April 2, 2003



Paul Thibodeau
Supervisory Patent Examiner
Technology Center 1700